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The Polisto-Lovat' bog system

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Abstract: Polisto-Lovat' bog system (European Russia, North-West) is a strictly protected peatland since 1994. Due to its large size (above 90.000 ha) and well-preserved status this bog system is a unique ecosystem which influences the water regime of the whole region. The Polisto-Lovat' mire system has more than 20 remnant lakes located in groups. It gives a start to a few small rivers. There are a numerous mineral islets which are scattered in the mire territory. In the past this region was known as a remote and swampy area "Polistovsky mire region" with a very sparse human population.
Polisto Lake (31.6 km^2) is a natural border of the bog system in the west. The lake is very shallow with a depth 1.1-1.3 m and it is actively overgrowing by *Phragmites australis*.
Polisto-Lovat' bog system was formed by terrestrialisation of shallow lakes on the place of a huge postglacial reservoir (nowadays Pri-Ilmen Lowland). Several separate mire massifs have developed and joined into one huge peatland during the Holocene. The maximum depth of peat deposits is 7.2 m.
The spatial vegetation structure of the bog system is very diverse. Bog pool complexes and hummock-hollow complexes with different ecological forms of Scots pine (*Pinus sylvestris*) are widespread in the central part. The most common plants are *Chamaedaphne calyculata*, *Oxycoccus palustris* and *Andromeda polifolia*. *Betula nana* and *Rubus chamaemorus* can be found as well. *Rhynchospora alba*, *Scheuchzeria palustris*, *Carex limosa* and *Sphagnum* species (*S. balticum*, *S. cuspidatum* and *S. majus*) grow in hollows in different combinations.
Transitional parts with *Scheuchzeria* and *Sphagnum* communities are typical as well. Margins are mesotrophic sedge mires with willow and birch. They are rich in orchids.
Historical data about the site as well as factual results of modern studies of bog flora and vegetation are given in this article.

Key words: North-West Russia, Polisto-Lovat' mire system, bog vegetation, mire conservation.

Introduction

This article is devoted to the Polisto-Lovat's bog system which is the largest peatland in the North-West of Russia. It can be considered as a typical one, a best example of watershed taiga bogs of European part of Russia.

The bog system is located on territory of Pskov and Novgorod oblasts (units of administrative division), which belong to the North-West economic region of Russia.

The total area of the bog system is more then 90.000 ha. It is situated on the southern part of Pri-Il'men' Lowland on the watershed of Polist' and Lovat' rivers (centre coordinates 57°15´ N 30°40´ E). The bog system consists of several raised bog complexes (or bog massifs according to Russian mire terminology) in various stages of development, with a number of convex centers and outlets streams (Fig. 1, 2). Hummock-hollow complexes (Fig. 3) and bog pool complexes are widely distributed on bog massifs, they occupied the most part of bog area. On satellite image (Fig. 4) we can see the whole bog system. It is easy to distinguish several relic lakes, the largest one has a name "Russkoe Lake".

The maximum depth of peat deposits is 7.20 m, the average depth is 3.3 m. The peat deposits are composed by *Sphagnum* peat. *Sphagnum magellanicum* peat prevails (KUZ'MIN 1997).

The bog system is protected by two State Strict Nature Reserves: Polistovsky and Rdejsky (both organized in 1994, S = 37.98 and 36.9 thousand hectares correspondingly). It was proposed to be taken un-

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Fig. 1: Stradnitsa.

Fig. 2: Khlavitsa.

Fig. 3: Hummock-hollow complex with Gorodok islets in the background.

der protection by BOTCH & MASING (1973). Recently it was included into the Russian Shadow List of Ramsar sites (WETLANDS IN RUSSIA 2000).

In the beginning of 20th century the Pskov local government organized several expeditions to study "the Eastern mire region". A leader of the investigations was well-known Russian phytosociologist Vladimir N. Sukachev. The first data on vegetation communities, flora of lichens and bryophytes, characteristics of peat deposits, as well as the first maps of mires were obtained (SUKACHEV 1910, FILATOV 1911, 1913, KAKS 1914, ABOLIN 1914, 1915).

Fig. 5 represents one of those maps, compiled by KAKS (1914). It shows the results of his studies around Dulovo lake in the southern part of Polistovskoe mire. "Mire formations" were used as the mapping units. They are listed in a legend and can be explained as physiognomic mire types.

FILATOV (1911) wrote, that a process of paludification goes very fast, mires are "attacking" the lands. As a probable reason he mentioned the human activity (construction of dumbs, water-mills, sluices on Polist' and Tsevla Rivers in between Tsevlo and Polisto Lakes and as a result worse drainage and fast covering with sediments lakes and rivers bottoms). KAKS (1914) observes the similar process around Dulovo Lake.

At the same time we have the archive data about the attempts of land owners to drainage the margin parts of bog system (KISLYAKOV 1905).

During centuries local population lived in mire surroundings. Traditionally they did hunting, picking berries, went fishing, they also had small crop fields. Mineral islands on mires were used as pastorals and place for grass-cutting. The small villages and farmhouses existed on big islands.

Ethnographer A. Faresov visited this area in the end of 19th century. He made interesting notes about people's trade, their behavior and life style. FARESOV (1900) wrote that people who lived on mires were rather tall and strong. He called them "Moss-people" or "Mochoviki" (Moss sounds as "Moch" in Russian).

The old legends are closely connected with mires. Local inhabitants developed

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their own terminology of mire types on the base of plants.

People get used to live among mires, even in nowadays children can get additional holidays from school if they go to pick berries with parents.

The next attempt to study the bog system was made in 20-30s of the 20th century. Complex expedition carried out a peat coring, vegetation descriptions along profiles and hydrological studies (GERASIMOV 1929, BOGDANOWSKAJA-GUIHENEUF 1933). As a result of long-term and detail studies the monograph about Polisto-Lovat' bog system was published (BOGDANOWSKAJA-GUIHENEUF 1969). It is considered as a classical work of Russian mire science.

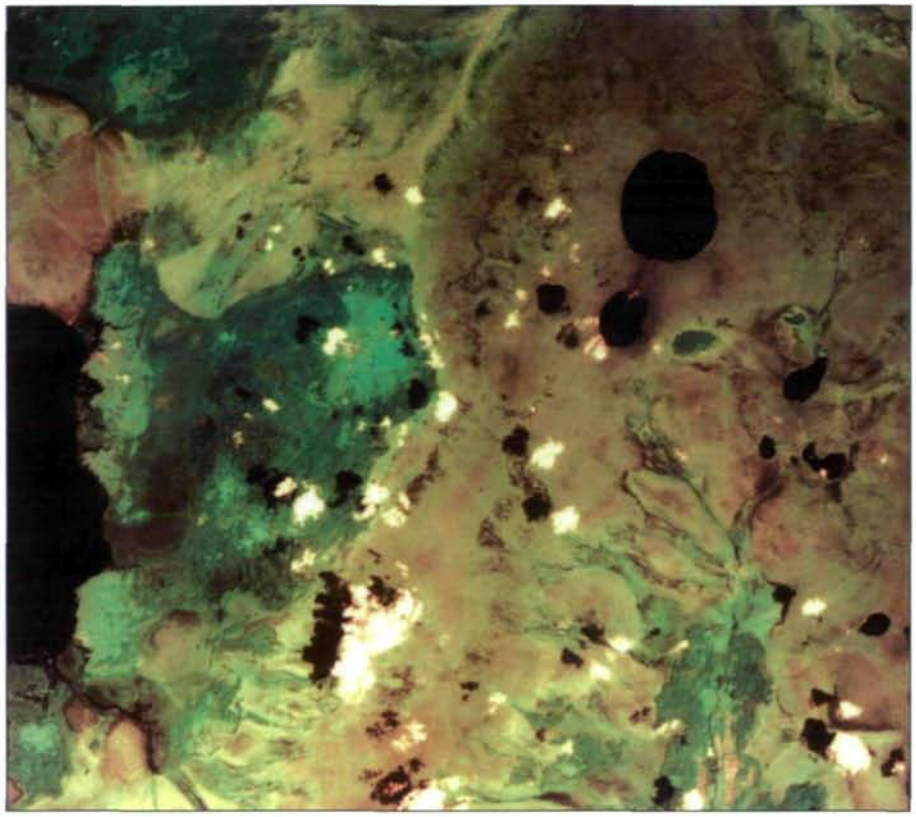

Fig. 4: A fragment of Polisto-Lovat' mire system on satellite image (date 06.07.1991).

Results

The results of peat coring are presented in Fig. 6. *Sphagnum magellanicum* peat plays important role in a stratigraphy of peat deposits in oligotrophic parts of mire system (Fig. 6A). *Sphagnum cuspidatum*-type of peat deposits (Fig. 6B) was found under the bog

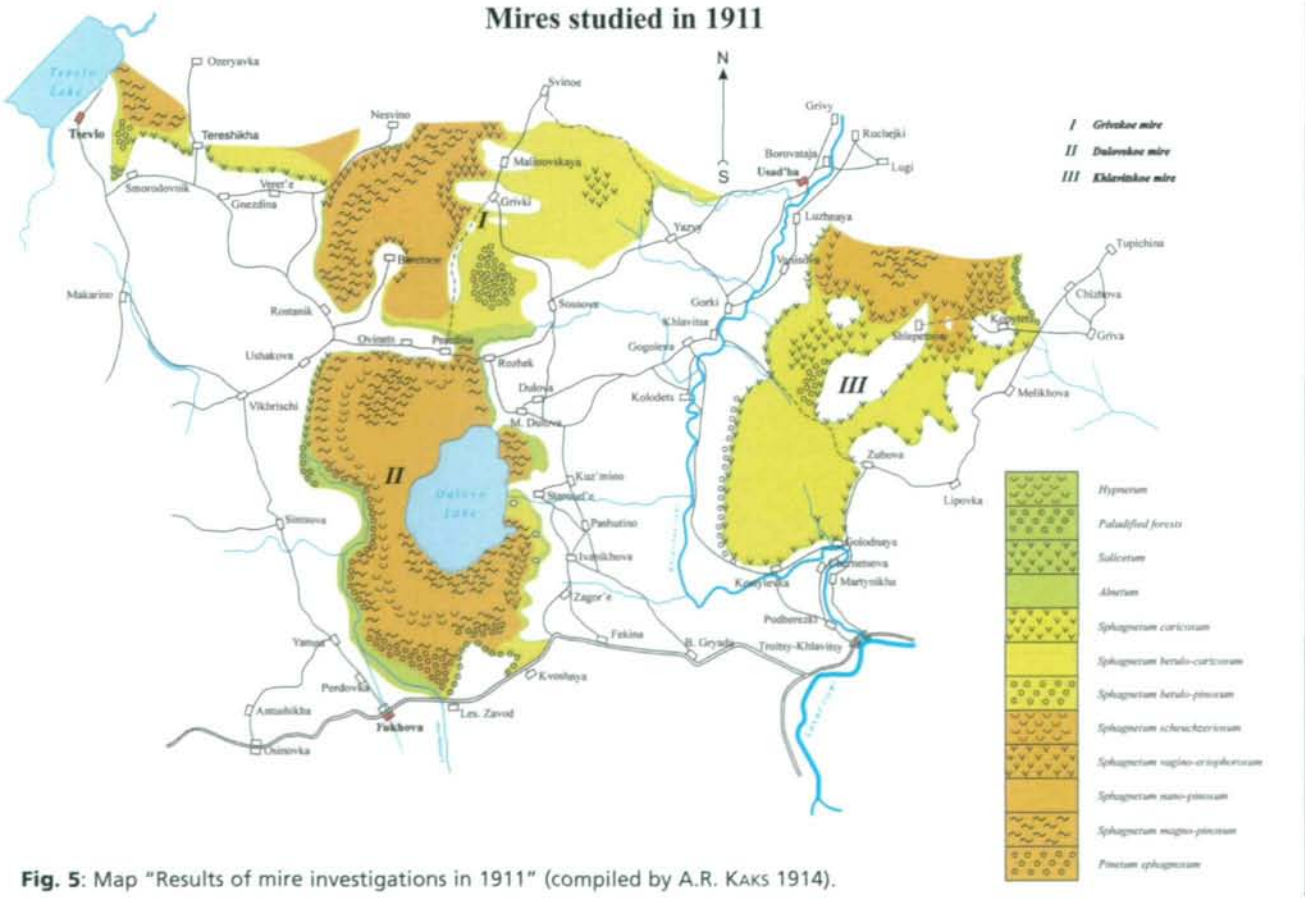

Fig. 5: Map "Results of mire investigations in 1911" (compiled by A.R. KAKS 1914).

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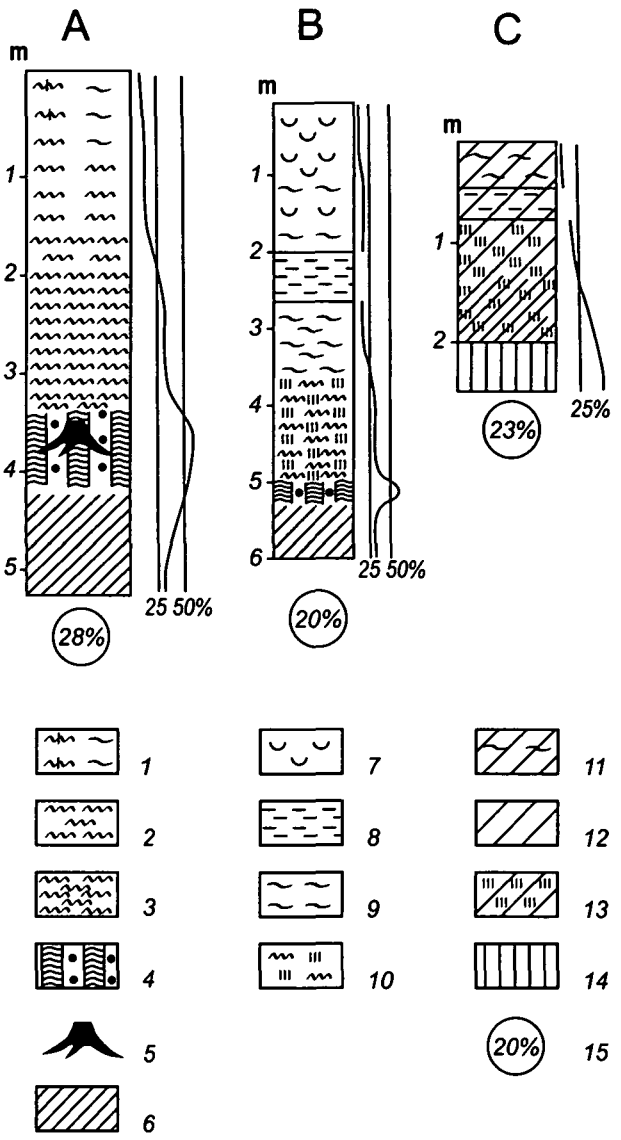

Fig. 6: Peat deposits of Polisto-Lovat' mire system (according to BOGDANOWSKAJA-GUIHENEUF 1969)
Peat deposit types: Ombrotrophic: A- *Sphagnum magellanicum*; B – *Sphagnum cuspidatum*; mesotrophic: C – Scheuchzeria
Peat types:
A.
1 – complex *Sphagnum* peat (*fuscum* and *cuspidatum*);
2 – *Sphagnum magellanicum* (degree of decomposition ≥ 25%;
3 – *Sphagnum magellanicum* (degree of decomposition ≤ 25%);
4 – pine- cotton grass peat;
5 – pine stump layer
6 – sedge peat
B.
7 – *Sphagnum Dusenii*;
8 – bog water;
9 – *Sphagnum balticum*;
10 – *Scheuchzeria*
C.
11 – *Sphagnum*;
12 – sedge;
13 – *Scheuchzeria*;
14 – woody fen peat;
15 – average degree of peat decomposition, % depth of peat, m – on the left degree of peat decomposition – on the right

hollows. *Scheuchzeria*-type of peat deposits (Fig. 6C) is wide-spread under the transitional mire complexes.

Special attention was paid by the author to the problems of mire system formation and development during the Holocene history. The pollen diagram (Fig. 7.) shows the same main levels as many other pollen diagrams obtained from Karelia, Leningrad oblast and Finland. A tendency of coming close to the curves of birch and pine is easy to distinguish in between the Boreal and the Atlantic periods. A maximum of birch pollen is typical for the Pre-boreal period.

During the World War II the territory was under German occupation for two years. The bog system became a place of partisan activities. As a result of the War the population in Pskov oblast decreased, but old villages existed up to "perestrojka" period (started in 1985), when people had to move from countryside because of collapse of Soviet collective farms. The situation turned into dramatic state, and in nowadays the adjoined area to the Polistovsky Reserve is uninhabited. A lot of villages which were shown on the Map of SCHUBERT (1853) are disappeared.

Absence of human activity can be considered as a luck for Nature, but from other hand we are losing cultural heritage, local traditions. For example, in 19th century the noble Sumarokoff family had a country-house near the Tsevlo Lake with library and beautiful park around (Fig. 8). In 2003 we found a few old *Tilia cordata* trees and some planted shrubs on high southern shore of the lake. But in former time, every year an autumn market took place in Tsevlo village where people usually came to sale their products and home-made things from nearest villages.

My study of Polisto-Lovat' bog system was done in a frame of agreement about scientific cooperation between Komarov Botanical Institute and Polistovsky State Nature Reserve. It was supported by RSS grant N 1516/1999.

Polistovsky Reserve extends S-N about 25 km. Primary southern taiga forests on watersheds were forced by cutting for centuries and they were replaced by secondary birch-aspen forests with presence of single coniferous trees (*Picea abies*). Sometimes broad-leaves elements such as *Tilia cordata*, *Quercus robur*, *Corylus avellana* can be found as well. Alder forests grow in swampy sites around bog margins.

Total list of vascular plants of Polistovsky Reserve consists of 468 species (KONECHNAJA & SERGIENKO 1999). 24 species are protected in Pskov region, among them *Betula nana* L., *Gladiolus imbricatus* L., *Dactylorhiza fuchsii* (Druce) Soó, *D. incarnata* (L.) Soó, *Hammarbya paludosa* (L.) O. Kuntze, *Hepatica nobilis* Mill and some others. *Dactylorhiza baltica* (Klinge) Orlova, species of the Red Book of Russian Federation, was found here as well.

A list of *Sphagnum* mosses of Polistovsky Reserve includes 21 species (GALANINA

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2000). Such species as *Sphagnum tenellum* (Brid.) Perss. ex Brid., *S. jensenii* H. Lindb. are the rare species of the North-West of Russia. BOGDANOWSKAJA-GUIHENEUF (1933) reported about presence of *Sphagnum lindbergii* Schimp. ex Lindb. and *S. pulchrum* (Lindb. ex Braithw.) Warnst. on bog system, but during my studies 1998, 2000 and 2003 they were not found.

Phytosociological studies of bog vegetation were carried out on plots along several profiles. Detail characteristics of mire sites (micro landscapes according to GALKINA 1946), synoptic tables, fragment of vegetation map are presented in early published article (GALANINA 2003).

Vegetation relèves were analyzed according to Braun-Blanquet classification method. Bog vegetation belongs to 12 associations. The following three associations are widely spread in bog hollows:

- Ass. Caricetum limosae Osvald 1923
- Ass. Scheuchzerietum palustre Tx. 1937
- Ass. Sphagno-Rhynchosporetum albae Osvald 1923 emend. Koch 1926

Regression bog pool complexes are occupied by association:

- Ass. Hepatico-Rhynchosporetum albae Bogdanowskaja-Guiheneuf 1928 em. Botch 1992

Vegetation of bog hummocks in hummock-hollow complexes are presented by 2 associations:

- Ass. Ledo-Sphagnetum fusci Du-Rietz 1921
- Ass. Chamaedaphne-Sphagnetum magellanici Bogdanowskaja-Guiheneuf 1928 em. Boč 1990
- Ass. Menyantho-Sphagnetum magellanici Botch et Smagin 1993 is typical for hummocks, which can be met in mesotrophic parts of bog system

In margin parts of bog system I described two wide-spread associations:

- Ass. Caricetum rostratae Osvald 1923
- Ass. Caricetum lasiocarpae Osvald 1923

The following three associations can be considered as non-valid ones in a frame of the Braun-Blanquet classification system, but they were distinguished and described on the base of data obtained from Polis-

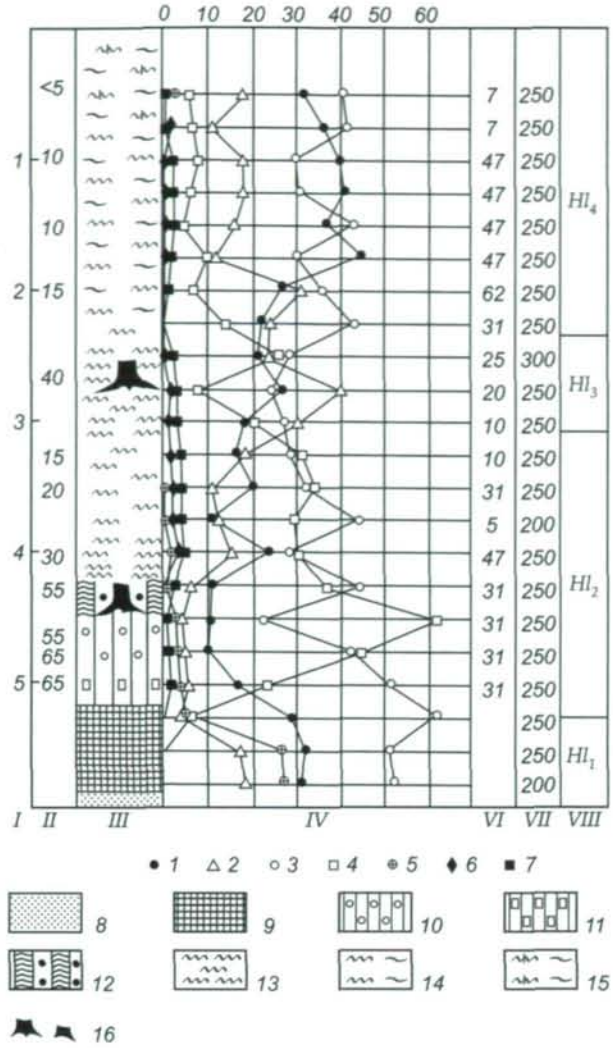

Fig. 7: Pollen diagram. Polistovskoe mire (by BOGDANOWSKAJA-GUIHENEUF 1969)
Explanation of the symbols:
Pollen of trees: 1 – pine, 2 – spruce, 3 – birch, 4 – alder, 5 – willow, 6 – hazel,
7 – broad-leaf trees.
Others: 8 – sand, 9 – clay gyttja; peat:10 – birch, 11 – woody, 12 – pine-cotton grass, 13 – *Sphagnum fuscum*, 14 – *Sphagnum magellanicum* complex;
15 – *Sphagnum fuscum* complex, 16 – pine stumps.
I – sampling depth, m
II – degree of peat decomposition, %
III – peat deposits
IV – pollen diagram
V – pollen of broad-leaf trees
VI – number of pollen grains (per m²)
VII – counted grains
VIII – periods of Holocene (Hl_1-aicent; Hl_2-early; Hl_3-middle; Hl_4-late) on the top – pollen percentage

Fig. 8: Tsevlo.

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tovskie mires and I like to use them in my studies.

- Ass. Pinetum-Sphagnosum Kaks 1914, (synonym Vaccinio uliginosi-Pinetum Hueck 1925) can be meet in separate small mires and well-drained slopes of raised bogs as well.
- Ass. Sphagnetum betulo-pinosum Filatov et Yurev 1913, (synonym Menyanthes-Eriophoro-Pinetum Passarge, Hofmann 1968). Association joints communities which are distributed in margin parts of oligotrophic and mesotrophic mires where the peat deposits are not deep (0.5-1.5 m).
- Ass. Sphagnetum magno-pinosum Filatov et Yurev 1913. (synonym Sphagnetum magellanici boreale pinetosum Jasnowski 1968). This association is typical for margin parts and slopes of raised bogs. Sometimes it occupies small mires completely.

KATZ (1948) developed a scheme of mire regionality for USSR and Western Europe. Among others he suggested to distinguish the Ladoga-Ilmen-Western Dvina province of oligotrophic hummock-hollow mires. As an example he mentioned the Polsito-Lovat bog system.

YURKOVSKAJA (1992) considers the Polisto-Lovat' bog system to belong to the Western-Russian type of bogs of taiga zone.

The bog system was studied by ornithologists. Preliminary list of bird contains 145 species. Among them are very rare birds and they are included Red Book of Russian Federation : *Gavia arctica*, *Aquila chrysaetos*, *A. clanga*, *Lagopus lagopus*, *Ciconia nigra* and some others (FETISOV et al. 1998).

In 1965-1968 Polisto-Lovat' mire system was studied thoroughly by the State Peat Survey company. Polistovsky peat basin consists of 15 beds. Their total size is 2.054 km^2 (industrial peat resources) (KUZ'MIN 1997). It was estimated as a prospective one for future peat extraction. In the early 1970s a big peat extraction company was established in Tsevlo village near the Tsevlo Lake. It started the highly mechanized extraction of peat for peat-fired power stations in Russia and worked up to the 1990s. Now the peat extraction is stopped here completely due to present economic problems in Pskov oblast.

Thus, some of the neighboring mires were excavated by peat industry during more then 20 years. But luckily political and economical changes helped to save for future generation the largest and almost untouched the Polisto-Lovat bog system, which is a unique natural ecosystem of European part of Russia.

Zusammenfassung

Der Polisto-Lovat' Moorkomplex – Der Polisto-Lovat' Moorkomplex, das größte Moor im Nordwesten Russlands, ist seit 1994 geschützt. Wegen seiner Größe und des guten Erhaltungszustandes ist der Moorkomplex nicht nur ein ganz außergewöhnliches Ökosystem, er beeinflusst auch den Wasserhaushalt der gesamten umliegenden Region. In diesem Moorgebiet liegen mehr als 20 in Gruppen angeordnete Seen, aus denen kleine Flüsse entspringen. Darüberhinaus gibt es auch zahlreiche Mineralbodeninseln, die über das ganze Gebiet verstreut sind. In früherer Zeit war die Polistovsky Moorregion als einsam und sumpfig verschrien und daher auch nur sehr dünn besiedelt.

Die Westgrenze des Gebietes wird vom Polisto See gebildet, der eine Ausdehnung von 31.6 ha hat, aber nur 1.1-1.3 m tief ist, und daher gegenwärtig stark mit Schilf verlandet.

Der Polisto-Lovat' Moorkomplex entwickelte sich aus der Verlandung von seichten Stillgewässern, die im heutigen Pri-Ilmen Tiefland aus einem ehemals großen postglazialen See entstanden waren. Die vielen, ursprünglich getrennten Moore wuchsen während des Holozäns zu einem einzigen großen Moorkomplex zusammen, der Torfmächtigkeiten bis zu 7.2 m erreicht.

Die räumliche Differenzierung der Vegetationszusammensetzung führt zu großer Diversität. Im Zentralbereich sind Kolke (Moorseen) und Bult-Schlenkenkomplexe mit den verschiedensten Formen der Waldkiefer (*Pinus sylvestris*) weit verbreitet. Die häufigsten dort anzutreffenden Arten sind *Chamaedaphne calyculata*, *Vaccinium oxycoccos* und *Andromeda polifolia*. Daneben findet man auch noch *Betula nana* und *Rubus chamaemorus*. In den Schlenken wachsen *Rhynchospora alba*, *Scheuchzeria palustris*, *Carex li-*

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mosa und verschiedene Torfmoosarten wie *Sphagnum balticum*, *S. cuspidatum* und *S. majus* in verschiedenen Kombinationen. Charakteristisch sind auch die Übergangsbereiche mit Blumenbinsen- und Torfmoosgesellschaften. Die mesotrophen Randbereiche werden von Seggengesellschaften besiedelt, in denen Weiden und Birken, aber auch zahlreiche Orchideen wachsen.

In der vorliegenden Arbeit werden neben den Untersuchungen zur Vegetationsgeschichte die Ergebnisse einer modernen Studie über die Vegetations- und Florenverhältnisse des Polisto-Lovat' Moorkomplexes dargestellt.

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